J. Cotton Res. Dev. **35**(2), 181-184 (July, 2021) **ISSN No. 0972-8619**

Estimates of direct and indirect effects among yield and yield contributing traits in American cotton (*Gossypium hirsutum* L.)

Y. SATISH*

Acharya N.G. Ranga Agricultural University, Regional Agricultural Research Station, Lam, Guntur-522034
**Email : tej.satish1@gmail.com*

ABSTRACT: Character association and path coefficient analysis was carried out with 55 genotypes for yield and yield component traits during *kharif,* 2019-2020 at Regional Agricultural Research Station, Lam, Guntur. The correlation studies revealed that seed cotton yield had positive association with plant height, bolls/plant, boll weight, seed index, lint index and ginning outturn suggesting that these were the major yield contributing traits. Further partitioning of correlation coefficients into direct and indirect effects showed that characters *viz.*, plant height, bolls/plant, boll weight, seed index and lint index had direct positive effect on seed cotton yield/plant. Thus, correlation and path analysis clearly indicated that direct selection based on bolls/plant, boll weight, seed index and lint index may be helpful in developing high yielding varieties in upland cotton.

Key words: Correlation, cotton, path coefficient

Cotton (*Gossypium* spp) is one of the most important commercial cash crops and plays a key role in economic, political and social affairs of the world. Cotton enjoys a pre-eminent status among all the cash crops in the country, being the principal material for flourishing textile industries. The predominant species cultivated in India is *G. hirsutum* which covers more than 90 per cent of the total area.

Seed cotton yield is a complex quantitative trait, considerably affected by environment. Therefore, selection of genotypes based on yield perse is not effective. Hence, it is desirable for plant breeder to know the extent of relationship between yield and yield components which will facilitate in selecting desirable characteristics for yield improvement. Correlation coefficient analysis measures the magnitude of relationship between various plant characters and determines the component character on which selection can be based for improvement of seed cotton yield. Path coefficient analysis splits the correlation coefficients and provides information on the direct and indirect effects in order to perceive the most influencing characters to be utilized as selection criteria in cotton breeding programme

MATERIALS AND METHODS

The present study was carried out with 55 genotypes of cotton in randomized complete block design (RCBD) with two replications at Regional Agricultural Research Station, Lam, Guntur during *kharif*, 2019-2020. The inter-row and intra-row spacing adapted was 105 x 60 cm. Each plot consisted of 2 rows of 6 m length and observations were recorded on five randomly selected plants from each genotype/replication for characters *viz.*, plant height (cm), monopodia/ plant, sympodia/ plant, bolls/plant, boll weight (g), seed index (g), lint index (g) and seed cotton yield/plant (g). The characters *viz.*, days to 50 per cent flowering and ginning outturn (%) were recorded on plot basis. The data collected from the experimental material was subjected to the correlation analysis and path coefficient analysis.

RESULTS AND DISCUSSION

The analysis of variance indicated significant differences among the genotypes for all the characters. The phenotypic and genotypic correlation coefficients between seed cotton yield and other yield components are presented in

Table 1. Phenotypic (below diagonal) and genotypic (above diagonal) correlation coefficients for yield and yield component characters among 55 genotypes of cotton (*Gossypium hirsutum* L.)

Character	Days to 50 per cent flowering	Plant height	Monopodia/ plant	Sympodia / plant	Bolls/ plant	Boll weight	Seed index	Lint index	Ginning outturn (%)	Seed cotton yield/ plant
Days to 50 per cent flowering	1.00	0.09	-0.03	-0.08	0.08	-0.12	-0.03	-0.01	0.02	0.08
Plant height (cm)	0.07	1.00	-0.29**	0.65**	0.28**	-0.02	-0.09	-0.04	0.02	0.27**
Monopodia/ plant	-0.02	-0.21*	1.00	-0.03	0.09	0.11	0.19*	0.12	-0.02	0.03
Sympodia/ plant	-0.07	0.54***	-0.02	1.00	0.38**	-0.18*	-0.24**	-0.17*	-0.04	-0.08
Bolls/plant	0.03	0.12	-0.02	0.24*	1.00	0.12	-0.01	0.07	0.17*	0.88**
Boll weight (g)	-0.10	-0.02	0.12	-0.16*	0.06	1.00	0.79**	0.71**	0.37**	0.69**
Seed index	-0.03	-0.03	0.17*	-0.20*	-0.01	0.72**	1.00	0.91**	0.49**	0.46**
Lint index	-0.02	0.01	0.10	-0.14	0.04	0.63**	0.89**	1.00	0.81**	0.47**
Ginning outturn (%)	0.01	0.04	-0.02	-0.02	0.11	0.29**	0.43**	0.78***	1.00	0.34**
Seed cotton yield/ plant (g)	0.05	0.15	0.04	-0.05	0.44**	0.48**	0.32**	0.33**	0.25**	1.00

* Significant at 5% level ** Significant at 1% level

Table 2. Direct and indirect effects (phenotypic) of yield component traits on seed cotton yield among 55 genotypes of cotton (*Gossypium hirsutum* L.)

Character	Days to 50 per cent flowering	Plant height	Monopodia/ plant	Sympodia/ plant	Bolls/ plant	Boll weight	Seed index	Lint index	Ginning outturn (%)
Days to 50 per cent flowering	0.05	0.00	-0.00	-0.00	0.00	-0.01	-0.00	-0.00	0.00
Plant height (cm)	0.02	0.24	-0.05	0.13	0.03	-0.01	-0.01	0.00	0.01
Monopodia / plant	-0.00	-0.01	0.07	-0.00	-0.00	0.01	0.01	0.01	-0.00
Sympodia / plant	0.012	-0.12	0.00	-0.23	-0.06	0.04	0.04	0.03	0.01
Bolls / plant	0.01	0.05	-0.01	0.10	0.42	0.03	-0.00	0.02	0.053
Boll weight (g)	-0.05	-0.01	0.06	-0.07	0.03	0.47	0.34	0.30	0.14
Seed index	-0.01	-0.01	0.07	-0.08	-0.00	0.29	0.39	0.35	0.17
Lint index	0.02	-0.01	-0.08	0.11	-0.03	-0.47	-0.66	-0.74	-0.57
Ginning outturn (%)	0.00	0.02	-0.01	-0.01	0.05	0.14	0.20	0.36	0.46
Seed cotton yield / plant (g)	0.05	0.15	0.04	-0.05	0.447**	0.48**	0.32**	0.34**	0.25**

* = Significant at 5% level, ** = Significant at 1% level, Residual effect =0.237, Bold and diagonal values indicate direct effects

Table 1 and the phenotypic and genotypic path coefficients showing direct and indirect effects are presented in Table 2 and 3 and Fig.1 and 2, respectively. Genotypic correlations in general were higher than phenotypic correlations indicating that the apparent associations are largely due to genetic reasons.

Plant height recorded significant positive association with sympodia/plant, bolls/plant and seed cotton yield/plant at genotypic level and with sympodia/plant at phenotypic level indicating their true association. Similar results were also reported earlier by Asha *et al.*, (2015), Pradeep *et al.*, (2015) and Satish *et al.*, (2020).

The characters *viz.*, bolls/plant, boll weight, seed index, lint index and ginning outturn also showed significant positive association with seed cotton yield/plant at both phenotypic and genotypic levels signifying the usefulness of these traits in selection programmes. Similar results were reported by Kishore *et al.*, (2011) and Sirisha *et al.*, (2016) and Satish *et al.*, (2020). Days to 50 percent flowering, monopodia/plant and sympodia/plant showed non-significant positive

Table 3. Direct and indirect effects (genotypic) of yield component traits on seed cotton yield among 55 genotypes of cotton (*Gossypium hirsutum* L.)

Character	Days to 50 per cent flowering	Plant height	Monopodia/ plant	Sympodia/ plant	Bolls/ plant	Boll weight	Seed index	Lint index	Ginning outturn (%)
Days to 50 per cent flowering	-0.01	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00	-0.00
Plant height (cm)	0.03	0.38	-0.11	0.25	0.10	-0.01	-0.03	-0.01	0.01
Monopodia / plant	0.00	0.00	-0.01	0.00	-0.00	-0.00	-0.00	-0.00	0.00
Sympodia / plant	0.05	-0.40	0.02	-0.61	-0.23	0.11	0.14	0.12	0.02
Bolls / plant	0.08	0.27	0.09	0.37	0.98	0.12	-0.01	0.06	0.17
Boll weight (g)	-0.06	-0.01	0.06	-0.09	0.07	0.53	0.42	0.37	0.20
Seed index	0.04	0.13	-0.27	0.34	0.01	-1.14	-1.43	-1.30	-0.70
Lint index	-0.03	-0.08	0.25	-0.36	0.14	1.46	1.88	2.07	1.67
Ginning outturn (%)	-0.02	-0.02	0.02	0.04	-0.18	-0.38	-0.50	-0.83	-1.03
Correlation with seed cotton yield/plant (g)	0.08	0.27**	0.03	-0.08	0.88**	0.69**	0.46**	0.47**	0.346**

* = Significant at 5% level, ** = Significant at 1% level, Residual effect = 0.212, Bold and diagonal values indicate direct effects

association with seed cotton yield/plant at both phenotypic and genotypic levels. These results are in accordance with Pujer *et al.*, (2014) and Sirisha *et al.*, (2016) and Satish *et al.*, (2020).

The traits *viz.*, bolls/plant, boll weight, seed index, lint index and ginning outturn were found to possess significant positive association in desirable direction with seed cotton yield/plant both at genotypic and phenotypic levels.

The correlation coefficient alone is insufficient to explain the relationship for effective manipulation of the traits, but path coefficient analysis furnishes a method for partitioning the correlation coefficient into direct and indirect effects and measures the relative importance of the causal factors in determining the seed cotton yield.

In plant breeding, it is very difficult to have complete knowledge of all component traits of yield. The residual effect permits precise explanation about the pattern of interaction of other possible components of yield. In other words, residual effect measures the role of the possible independent variables which were not included in the study on the dependent variable. In the present study, the residual effect observed at phenotypic (0.237) and genotypic (0.212) explains that the characters chosen for path analysis were adequate and appropriate.

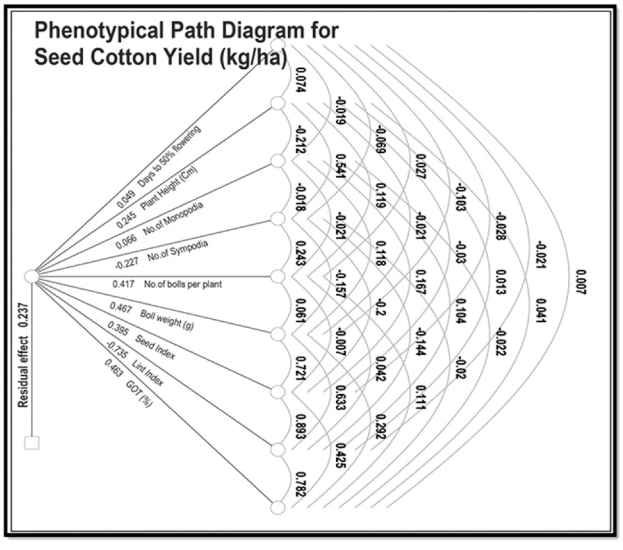

Fig.1: Phenotypical Path Diagram for Seed Cotton Yield

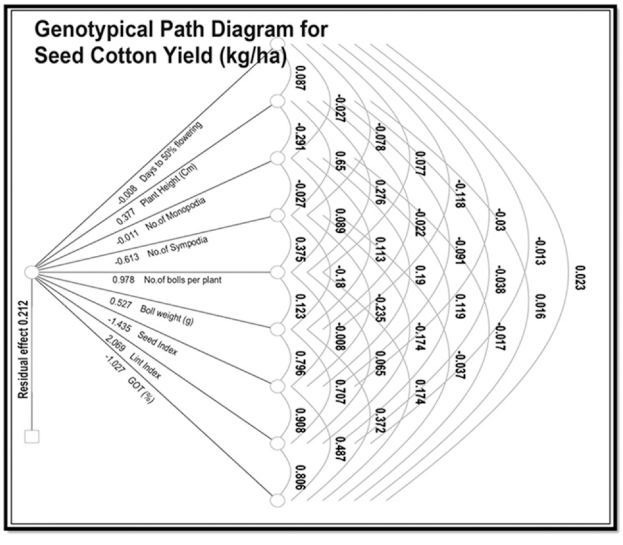

Fig.2: Genotypical Path Diagram for Seed Cotton Yield

Among the characters studied, the traits *viz.*, plant height, bolls/plant, boll weight, seed index, lint index and ginning outturn showed direct positive effects, besides expressing significant positive correlation with seed cotton yield. Therefore, direct selection of these traits is suggested for obtaining yield improvement. Similar results were also reported by Pradeep *et al.*, (2015) and Satish *et al.*, (2020). However, negative direct effect was observed for days to 50 per cent flowering, monopodia, sympodia, seed index and ginning outturn. These results are in accordance with the results reported by Pradeep *et al.*, (2015), Sirisha *et al.*, (2016). This study revealed that, the traits which had positive and direct effect on seed cotton yield should be given emphasis for making selection for high yielding genotypes.

Thus, the present study indicated that bolls/plant, boll weight, seed index, lint index and ginning outturn showed direct positive effects and significant positive correlation with seed cotton yield/plant and also revealed that the major emphasis should be laid on selection process with these traits without sacrificing desirable fibre qualities by adopting restriction selection model. Similar results were reported by Erande *et al.*, (2014), Pradeep *et al.*, (2015), Sirisha *et al.*, (2016) and Satish *et al.*, (2020).

From correlation study, it is concluded that seed cotton yield had positive association with plant height, bolls/plant, boll weight, seed index, lint index and ginning outturn advocating that these were the major yield contributing traits. Further path coefficient analysis exhibited that characters *viz.*, plant height, bolls/plant, boll weight, seed index and lint index had direct positive effect on seed cotton yield/plant. Thus, correlation and path analysis clearly suggested that direct selection based on bolls/plant, boll weight, seed index and lint index may be useful in developing high yielding varieties in upland cotton.

REFERENCES

Asha, R., Ahmed, M.L., Babu, D.R and Kumar, P.A. 2015. Character association and path coefficient analysis for yield and component traits in upland cotton. *J. Cotton Res. Dev.* **29**: 31-35.

Erande, C.S., Kalpande, H.V., Deosarkar, D.B., Chavan, S.K., Patil, V.S., Deshmukh, J.D., Chinchan, V.N., Anil, K., Utpal, D and Puttawar, M.R. 2014. Genetic variability, correlation and path analysis among different traits in *desi* cotton (*Gossypium arboretum* L.). *African J. Agric. Res.* **9**: 2278-86.

Kishore, D.K., Gopinath, M., Rao, V.S and Rao, V.S. 2011. Genetic variability studies in upland cotton. *The Andhra Agric.* J. **58**: 17-21.

Pradeep, S., Satish, Y., Ratna Babu, D and Srinivasa Rao, V. 2015. Character association and path coefficient analysis for yield and yield component traits in upland cotton (*Gossypium hirsutum* L.). *The J. Res. ANGRAU.* **42**: 32-35

Pujer, S., Siwach, S.S., Deshmukh, J., Sangwan, R.S and Sangwan, O. 2014. Genetic variability, correlation and path analysis in upland cotton (*Gossypium hirsutum* L.). *Electron. J. Plant. Breed.* **5**: 284-89.

Satish, Y., Sudha Rani, M and Rani Chapara. 2020. Correlation and path coefficient analysis for yield and yield component traits in upland cotton (*Gossypium hirsutum* L.). *Int. J. Chem. Stud.* **8**: 2742-46

Sirisha, A. B. M., Lal Ahamed , M, Rama Kumar, P.V., Ratnakumari, S and Srinivasa Rao, V. 2016. Correlation and path analysis studies in cotton (*Gossypium hirsutum* L.). The *Andhra Agric.* J. **63**:104-09.

Received for publication : March 7, 2021
Accepted for publication : May 19, 2021